DOCUMENT RESUME

ED 397 828 IR 018 016

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TITLE Robert M. Gagne's Impact on Instructional Design Theory and Practice of the Future.
PUB DATE 96
NOTE 12p.; In: Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology (18th, Indianapolis, IN, 1996); see IR 017 960.
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Context Effect; Design Preferences; Educational Practices; Educational Psychology; Educational Technology; *Educational Theories; Educational Trends; Individualized Instruction; *Instructional Design; Instructional Development; *Theory Practice Relationship
IDENTIFIERS Conceptual Frameworks; Design Research; *Gagne (Robert M); Instructional Design Professionals; Learner Centered Instruction

ABSTRACT

Robert Gagne has been a central figure in the infusion of instructional psychology into the field of instructional technology, and in the creation of the domain of instructional design. Gagne's design principles provide not only a theoretical orientation to an instructional design project, but also have prompted a number of design conventions and techniques. This paper examines the extent to which Gagne's theories continue to influence the field as design research expands and as design practice changes in response to new demands and pressures. Discussion includes the emerging tension between learner-oriented and content-oriented instruction trends in learner-centered instruction; the role of learner characteristics, learner involvement, and individualized instruction in Gagne's work; the emerging role of context in instructional design theory trends in context-centered instruction; the generic nature of Gagne's design theory and the de-emphasis of rooting design in a single context; the continuing dominance of Gagne's learning conditions, outcomes-based design, pre-design analysis, and Events of Instruction which provide a framework for creating those external conditions that promote learning; and the stability of Gagne's orientation to practice. (Contains 27 references.) (AEF)

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**Title:**

# Robert M. Gagne's Impact on Instructional Design Theory and Practice of the Future

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Instructional Technology is a field that has grown from two separate knowledge bases and two related areas of practical concern. While its original roots were in the study and construction of visual aids as teaching devices, the second major line of intellectual heritage emanated from instructional psychology, and provides the bases for many principles of instructional design theory and practice. Gagne has been a central figure in this infusion of psychology into the field, and indeed in the "creation" of the domain of instructional design. Today, the bulk of the research and theory in Instructional Technology is concentrated in the design domain with less research emphasis place upon utilization, management, evaluation, and even the important domain of development (Seels & Richey, 1994).

Instructional design can be seen in terms of either macro-design procedures which provide overall direction to a design project (typically using instructional systems design principles) or micro-design that involves the design of lessons and instructional strategies which constitute those lessons. Gagne's contributions have been primarily in the development of micro-design principles and procedures.

Gagne's orientation to design now serves as the crux of most micro-design models, such as in Instructional Transaction Theory (Merrill, Li, & Jones, 1991), Elaboration Theory (Reigeluth and Stein, 1983), or the ARCS Model of Motivation Design (Keller, 1987). In each of these models, learning is fundamentally viewed as an internal process that is:

- dependent upon past learning; and
- stimulated and controlled by external events;
- expedited by instruction which varies depending upon the nature of the desired outcome; and
- precipitated by the use of sequenced instructional strategies that provide motivation, direction, guided practice, feedback, and reinforcement.

These ideas emanate substantially from the work of Robert Gagne.

The principles promoted by Gagne provide not only a theoretical orientation to an instructional design project, but also have prompted a number of design conventions and techniques. His ideas are now reflected in a variety of work environments, including corporate training, the military, the health care industry, as well as educational settings. In addition, his design principles have been integrated into delivery systems of all types.

The key question to be examined in this paper, however, is "To what extent will Gagne's theories *continue* to influence the field as design research expands and as design practice changes in response to new demands and pressures?". While Gagne's dominance has been assumed in the past, this question is not unrealistic in the current climate of growing alternative perspectives of both research and design processes. Today's intellectual climate is subject to many pressures from new theoretical orientations, as well as from on-the-job demands for additional efficiency and effectiveness. These changing pressures and ideological influences may also control the impact of the Gagne design orientation.

Nonetheless, Gagne's influence has been so pervasive that it is easy to find traces of Gagne theory even in the most divergent design orientations. The aim of this paper is not so much to further identify Gagne's imprint on our field in *emerging* design theory and practice, but rather to analyze these trends in an effort to predict the stability and continuing relevance of his theory.

## The Continuing Domination of Gagne Doctrines in Design Theory

Previously unvoiced challenges to traditional principles of instructional design theory are now surfacing in the field. To a great extent, these challenges stem from criticism of our heavy reliance upon general systems theory and conventional learning theory. New learning and instructional theory, especially those positions concerning the role of the learning task, the impact of the learner and learner control, and increased concern with the need for transfer of training, is closely related to Gagne's work. These innovations are presented within the context of constructivism, situated learning, and an even more pronounced emphasis on cognitive psychology principles. As a whole, they raise the possibility of fairly profound changes in design practice.

### *The Emerging Tension Between Learner-Oriented and Content-Oriented Instruction*

*Trends in Learner-Centered Instruction.* Instructional design procedures are guided by both the nature of the learning task and the nature of the learner. With respect to the learning task, Gagne's work leads to an analysis of the content so that one can not only determine the sequence of a lesson, but also diagnose the prerequisite skills of the learner (Gagne, 1962, 1968a; 1968b). Instructional strategies are also contingent upon the learning task, since they vary depending upon the type of task being addressed. For example, problem solving tasks are taught differently from concept

formation tasks. While learner characteristics are clearly important, traditionally instructional design procedures have been controlled more by the *material* to be taught than by the *persons* receiving the instruction. This position is totally compatible with the objectives-oriented stance of instructional systems design models. However, to many it is also an outdated vestige of behavioral learning theory.

Currently, there are trends toward a change in this stance with much of the new theoretical thinking focusing more centrally on the learner, with content taking a somewhat secondary role (Richey, 1993). This is most evident in constructivist theory that posits that meaning and reality are functions of individual interpretation (Jonassen, 1991; Lebow, 1993), and learning itself is a process ...

> ... in which the learner is building an internal representation of knowledge. ... This representation is constantly open to change, its structure and linkages forming the foundation to which other knowledge structures are appended. Learning is an active process in which meaning is developed on the basis of experience (Bednar, Cunningham, Duffy, & Perry, 1992, p. 21).

Central to constructivism in its most extreme form is the rejection of the notion of an objective reality and the role of external events (i.e., external conditions of learning) as ways of promoting a common reality for a group of people (Jonassen, 1991). In other words, the emphasis on an individual's internal processing of information is completely dominant. The learner and learning processes control, and even shape, the learning task.

In spite of the growing popularity of constructivist principles, many designers are uncomfortable with extreme constructivist positions. Dick's (1992) comments in this regard are noteworthy. He observes that educational interventions that are truly constructivist must necessarily provide the learner with almost total control of the instructional process, *including* the selection of objectives and learning activities. This is less because of an adherence to laissez-faire philosophy than it is to a belief that pre-designed instruction is meaningless since two individuals will seldom have the same interpretation or understanding of a particular event. This position minimizes the role of structured instructional activities, in favor of a more tutorial model of instructional facilitation. Merrill (1992) also argues against extreme constructivism by pointing out that while learners develop their own internal mental models in most instructional situations, they nonetheless do respond to and interact with abstractions and mental models of others. There is a functional, objective core of knowledge that can easily co-exist with individual interpretations and opinions of the knowledge.

Questions regarding the dominance of content are not confined, however, to constructivists. Many involved in design and development of instruction using the new and emerging technologies have also come to question traditional practice. Hannafin (1992) argues that traditional instructional design theory and models are most effective with "highly prescribed, objective outcomes and the organization of to-be-learned *lesson content*, not the largely unique and individual organization of *knowledge*" (p. 50). Instruction controlled by these pre-defined objectives then tends to be seen as only the transmission of knowledge, rather than the facilitation of learning. Kember and Murphy (1990) voice concerns that the product of such instruction is only surface, rather than deep learning. It is learning that is less likely to be transferred and used by the learner in new situations.

It is predictable that constructivists and technology developers would find common ground in these arguments. The new technologies can facilitate levels of learner control previously unattainable. The technologies can give learners instant access to information, and the ability to link information. The technologies allow totally adaptable, interactive, and less structured designs and learning environments than were typical using traditional design orientations (Hannafin, 1992). Here the content becomes *part* of the learning environment, but the learner is more dominant.

*Learner-Centered Design and Gagne.* The learner-centered advocates, even those who espouse a more extreme position, do not have theoretical bases that are totally incompatible with Gagne's theory. He stresses the importance of prior knowledge and experience, self-regulated learning strategies, and learner motivation. However, there is a different perspective in the Gagne orientation. While Gagne uses learner characteristics as one basis of strategy selection, the pertinent learner considerations tend to relate to the cognitive processing of information -- the nature and capacity of the learner's memory storage and processing skills, qualities that affect sensory perception, and attitudes that directly impinge on learning. These are factors which shape one's ability and motivation to achieve a given type of learning outcome. They define the learners' cognitive capabilities, prerequisite content knowledge, and interest in a particular topic, and become central to the design of those external conditions that promote learning. Learner characteristics, however, are critical to Gagne's theory primarily in the extent to which they are related to *pre-defined* learning objectives.

Learner involvement (as opposed to learner control) is also a critical aspect of Gagne's work, but learners' participation in the instructional process entails more than simply being engaged in a series of activities, the external

performance aspect of instruction. Participation and activity also refer to internal involvement in the perception, storage, and retrieval of information. This is the core of Gagne's cognitive orientation, and the Events of Instruction are designed to promote internal, as well as external activities.

Current advocates of learner-centered instruction present arguments that are multi-faceted, including debates on at least two aspects of the problem:

- who controls the instructional process, and what is the nature of such control? and
- which learner characteristics influence the selection and design of instructional strategies and how they should be addressed?

With respect to the first question, Gagne seems to suggest that the designer (or the instructor) has fundamental control of *instructional* processes that are external events, even though individuals always control their own *learning* processes which are internal events. Superior design of instruction can facilitate learning efficiency, instructional effectiveness, transfer of training, and interest. In these respects then, the designer also exercises a certain amount of control by structuring the external conditions according to research-based principles in a manner that will facilitate internal learning and information processing. Control of the teaching/learning process then is shared by learners and designer/instructors.

Although seldom framed in these terms, the issues surrounding control of instruction seem to have much to do with the type and extent of individualization that is desirable in a teaching/learning environment. Individualized instruction has always been valued by instructional technologists, in spite of the many interpretations of the term. Fundamentally, individualized instruction involves varying the teaching/learning procedures for each student. These variations occur by making different instructional decisions for different students. These decisions include:

- what and how much should one learn?
- when and where should one learn?
- what resources should one use to learn?
- how does one know when learning has occurred or when it has not?

The extent of individualization depends upon the number of decisions made for individuals as opposed for the class as a whole, and the extent to which learners assume control of the decisions regarding their own instruction. For example, an individualized setting may only involve self-pacing of instruction by the students with the content, materials, and testing procedures prescribed by the instructor. On the other hand, a program may be totally individualized with learners making all of their own decisions, and instructors serving as facilitators. Technologically-based delivery systems clearly expedite learner control. For example, most hypertext environments at the least allow students to control content selection, sequencing, and pacing.

Constructivists and many of those involved in using the new technologies to their fullest advantage, tend to advocate more total individualization. Such instruction is not necessarily incompatible with Gagne's principles of learning. Moreover, the compatibility is not dependent upon whether there is a structured or flexible approach to the management of its delivery. Learners can assume a major part of the control of the instruction, and the process can still be perfectly consistent with Gagne's theory. The critical factor seems to be whether the design of this instruction has been grounded in an analysis of the subject matter and the learner prerequisites, not on whether students are involved in collaborative, active learning of highly relevant content.

In some respects, the second aspect of the learner-centered issue is more interesting -- the most critical learner characteristics. Instructional design rooted in a content emphasis, as opposed to a learner emphasis, tends to highlight learner traits that are related in some way to the subject matter of the lesson, including:

- prerequisite skills;
- background experiences which enhance prerequisites and/or interest in the topic of the lesson; or
- the learner's proficiency in those cognitive strategies required to master the content.

Designers are now considering other learner characteristics as well. For example, Richey (1992) has shown the direct impact on learning of other learner characteristics that are not content-related. With respect to adult learning in employee training environments, pertinent factors include learner attitudes toward the instructional delivery system and the organization delivering the training, the previous training experiences of learners, and their work experience. These learner attitudes and background experiences seem to predict not only the extent to which objectives are achieved during training, but also the extent of transfer. Other characteristics currently being studied include feminist thinking (Gilligan, 1982; Canada & Brusca, 1991) and other aspects of a person's cultural background.

It is possible for one to argue that these characteristics shape the cognitive strategies that a learner uses to address a particular piece of instructional content and, as such, are still within the Gagne tradition. Nonetheless, they do represent a line of thinking which, even though logically connected to Gagne's previous work, is suggesting new design procedures and emphases. It is one, however, which is consistent with Gagne's past thinking.



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*The Emerging Role of Context in Instructional Design Theory*

*Trends in Context-Centered Instruction.* Another area of current theoretical expansion concerns the impact of context upon the teaching/learning process. Of interest, is not only the immediate teaching context, but also the pre-instructional and post-instructional environments in which learners live and work (Richey, 1993; Richey & Tessmer, 1995).

This trend of looking to contextual variables as predictors of learning effectiveness has emerged with the concurrent influence of performance technology, the quality movement, situated learning, systemic design, and once again, constructivism. The commonalty among these divergent theories and movements is an interest in "meaningful" instruction, meaningful to the learner and meaningful to the society that expects to be improved as a result of an educated populace. In the past, such "meaning" has had important implications for the transfer of training from educational environments to real-life behavior. Today, it also has implications for organizational development and quality improvement.

Most instructional design procedures and principles are typically seen as being applicable to all settings. In spite of this, new instructional systems design procedural models are frequently developed in an effort to respond to the seemingly unique aspects of a given situation. This emphasis on situation-specific procedures is complemented by the ever increasing demands that education and training programs serve as quality improvement vehicles and solve specific organizational problems. Contextualization also reflects efforts to create motivating, relevant instruction. While this latter goal is not new, the pressures for intrinsically relevant instruction are increasing with the new emphases on adult education and training and the expectations of children and adolescents reared on action-oriented television. Finally, these events coincide with situated learning and constructivist emphases on "anchoring" instructional activities into meaningful contexts as a means for promoting long-term retention, understanding, and transfer of training. The issue is then an outgrowth of societal changes, as well as new theoretical biases.

The emphasis on context and environment is not unrelated to the learner-centered design thrust, since context is typically a matter of perceptions made by learners in light of their background experiences. Moreover, context emphases also tend to expand the number of factors addressed by designers, sometimes at the expense of instructional content considerations.

Contextualization is typically achieved not only through the topics of instruction, but also through the selection of examples and the nature of the practice exercises. Topics can be those that are currently issues in a particular setting. Examples can be drawn from the social or work culture of the students. Practice can be provided using what Brown, Collins, & Duguid (1989) would call authentic activities. Authenticism involves "ordinary practices of the culture" (p. 34), as opposed to hybrid activities that are more reflective of the education and training culture rather than the "real world". Decontextualized environments, therefore, are not only created through the use of verbal abstractions, but also through the use of examples and practice activities that are not reflective of the daily situations encountered by the learners. One can also create context-rich instruction by using problems, examples, and practice activities involving *multiple* contexts. In this way, instruction seems realistic, even though it is not "anchored" in a given context. This is not the typical approach, however, in many of the newer approaches to context in instruction.

Current emphases on context have the potential of changing design procedures by not only expanding the needs assessment, evaluation, and systems maintenance phases, but also by altering the nature of the instructional strategies themselves. The ultimate goal is instruction that is less abstract, more applied, and more responsive to external realities than had previously been the case.

*Context-Centered Design and Gagne.* Streibel (1991) summarizes the fundamental difference, in his opinion, between Gagne's theory of instruction and that of situated learning with respect to contextual issues. He sees environmental factors in the Gagne tradition as playing the role of triggering stimuli in a teaching/learning situation, rather than serving as *causes* of behavior. While this characterization may be debatable, the point is well made that context is not as central in the Gagne theory as it is in many current orientations, and the question at hand involves the extent of this deviation. This issue can be analyzed in terms of the implications of context for transfer of training as well as long-term retention -- elements that are not unrelated and need to be considered together.

Transfer of training, from Gagne's perspective, is a function of the extent to which a learner has:

- the required prerequisite knowledge and skills;
- the ability to recall prior learning; and
- developed those cognitive strategies appropriate for the task.

The first is a function of content and background, rather than contextual elements of the instruction. The latter two elements, however, are impacted by context. The ability to recall needed prior learning is a function, in part, of

whether the material to be recalled was originally presented within a meaningful contextual framework. If so, it is far easier to recall. Moreover, the contextual anchoring of past instruction in a variety of novel problem-solving tasks not only enhances meaning, but also develops cognitive strategies used in problem solving and transfer of training. Gagne, therefore, tends to advocate context-rich instruction by systematically using alternative contexts for practice, rather than emphasizing the dimensions of only one environment.

What is more likely to strengthen transfer, generalization or context-embedded instruction? Clark and Voogel (1985) conclude that "the extent of transfer is determined, in part, by the amount of decontextualization achieved during instruction" (p. 119), but that the issue is also dependent upon the nature of the learning task and the type of transfer anticipated. Procedural knowledge is more conducive to near transfer (i.e. transfer of skills to situations which are similar to those in which the instruction occurred), while concepts and principles are more appropriate for far, or more generalized, transfer situations. Moreover, Clark and Voogel (1985) assert that the two types of transfer are *not* compatible; one is typically emphasized at the expense of the other, even though all transfer is highly dependent upon learner abilities. In this vein, Gagne would likely assert that even though putting instruction into a meaningful context is important, instruction that is dominated by examples from real-life situations is not necessarily in the best position to promote the process of *far* transfer. This point is one important part of the discussion of differences between Gagne and the advocates of highly context-centered instruction.

Perkins and Salomon (1989) in essence have discussed the same issue, but in terms of the dichotomy between the roles of general strategic knowledge (i.e. decontexualized) and specialized domain knowledge (i.e. contextualized) as predictors of effective problem solving. They conclude that transfer is a highly specific phenomenon and while all specific applications need to consider contextual factors, there is a need to have an "intimate intermingling of generality and context-specificity in instruction" (p. 24). This seems not so very different from Gagne's position of embedding context within the instructional strategies, even though the ultimate goal is to facilitate far transfer.

There is a second aspect of Gagne's work and orientation that needs to be considered when discussing the role of context in promoting both transfer of training and long-term retention -- namely, the role of the enterprise schema (Gagne & Merrill, 1990). An enterprise is a complex *purposive* performance involving multiple, related instructional goals. It is a higher level goal than is frequently used in many education and training programs. An enterprise is represented in one's memory by a schema that relates these larger goals (typically presented as a realistic application task) to their prerequisite skills and knowledge. The schema is a mental model that serves as the basis for both retention and retrieval, as well as transfer.

The emphasis on integrated instructional goals corresponds with an emphasis on purposive, relevant instruction. While such instruction is designed with transfer in mind, it may not be authentic in the same sense promoted by advocates of situated cognition that seems to view learning as more of an enculturation process. The notions of integrated goals and enterprise schema tend to relate more to *generalized* transfer and a de-emphasis of declarative and procedural learning as an end unto itself. While Gagne would undoubtedly use contextualized examples and practice activities, it is unlikely that he would advocate always rooting instruction in a *single*, even though relevant, context. The most useful enterprise schema is somewhat generic, applicable to a variety of specific enterprises in which one might become engaged. Of course, much instruction, especially that of a training nature, is oriented only toward specific performance-oriented objectives that are more conducive to near transfer, and these situations often demand strategies which utilize a given context.

In summary, Gagne's orientation to context is not totally incompatible with current thinking insofar as it stems from a cognitive orientation. Gagne continues to strive for instruction that primarily addresses higher levels of learning and aspires to far reaching transfer as opposed to specific applications of content. Effective instruction is relevant to learners' needs as well as being appropriate to their skill levels, but probably shows application in a variety of contexts rather than being "anchored" in only one environment. While procedural knowledge is apt to be related to more specific uses, the goal, nonetheless, is that of using such knowledge in combination with other skills and knowledge for creative problem solving. Ultimately, Gagne's design theory is generic in nature. It is theory that is applicable to all contexts, all types of content, and all types of learners.

*The Stability of the Gagne Orientation to Theory*

A clear trend in design theory over the past fifty years has been its continual expansion. There is more research. There is more theory construction. Just as Gagne responded to those issues that were critical during his most productive years, today's scholars are responding to a new set of concerns. While it is evident that the new theorizing is at times charting new waters, for the most part new theory is not antithetical to the old and, it continues to build upon Gagne's foundational work. It is likely that Gagne's *primary* positions will remain current to the extent that:

- cognitive learning principles continue to be accepted;
- design continues to be viewed as a generic activity; and
- instructional content and strategies continue to be pre-specified and analyzed.

There are now alternatives to each of these perspectives that present radically new design orientations; although, they remain on the fringe of acceptability. Their acceptance as more mainstream theory could modify Gagne's impact on future theory development. However, at this time, such a scenario seems unlikely.

## The Continuing Domination of Gagne Doctrines in Design Practice

As with theory, the world of design *practice* is also undergoing changes that were previously unanticipated. These changes are, on the whole, reactions to demands for increased design efficiency. Such concerns are especially reflected in current efforts to enhance the traditional instructional systems design models and to reduce design cycle time.

In the preface to the first edition of *The Conditions of Learning* Gagne (1965) indicated that the impetus for this book was to explain "what is known about the process of learning that can be put to use in designing better education" (p. v). This reflects the fundamentally practical nature of instructional design. From one edition to the next, *The Conditions of Learning* became increasingly more practice oriented, and the final edition included four chapters describing specific design and analysis procedures and techniques. The question now is basically the same as was posed with respect to his theoretical contributions. Will Gagne's design and development techniques continue to provide direction for the typical practitioner?

In the past much of his direction for practice has related to techniques for varying designs in terms of the type of learning task, for using learning hierarchies as a pre-design content analysis tool, and for using the events of instruction as a guide for the design of lessons and the selection of instructional strategies. Clearly these tactics are bi-products of Gagne design theory. While their continued use by the typical practitioner is dependent upon the stability of this underlying theory, such use is also greatly affected by the realities of the everyday world of work.

### *The Continuing Dominance of Conditions and Outcomes-Based Design*

The core of Gagne's contributions to instructional design relates to the premise that learning is brought about by arranging different instructional conditions for different types of learning tasks. Gagne has identified five different domains of learning outcomes, and has suggested varying conditions that are likely to lead to a learner achieving each of these types of goals (Gagne 1965, 1972). This approach is foundational to most instructional design models. It is difficult in today's climate to imagine a field of instructional design without such an orientation.

While there is currently more advocacy of alternative design positions than has previously been the case, this principle seems to be essentially unchallenged by practicing designers. It is not that other instructional foundations have not been suggested, such as the developmental level of the learner, or the use of reinforcement. While Gagne's conditions of learning recognize the role of such elements, the basic principle remains -- instruction should vary depending upon what is to be learned.

> The only major dissension with respect to this position is voiced by constructivists who do not ...
> ... accept the assumption that types of learning can be identified independent of the content and the context of learning. Indeed, from a constructivist viewpoint it is not possible to isolate units of information or make a priori assumptions of how the information will be used. Facts are not simply facts to be remembered in isolation (Bednar et al., 1992, p. 23).

Gagne (as have most instructional designers) has often noted the futility of teaching isolated facts, even though he would nonetheless argue that such content can be classified. It is far more common today for the Gagne position to be supported with respect to this issue, and there is no indication that his basic premise will not remain essentially in tact. Other elements of design practice according to Gagne, however, are to some extent more debatable, even though they too are prevalent among practitioners.

### *The Continuing Dominance of Pre-Design Analysis*

Gagne's emphasis on pre-design content analysis coincides with the tenets of general systems theory. The use of the learning hierarchy tool facilitates such analysis as well as the identification of necessary learner prerequisites. Today there are two seemingly opposing trends. The first is to expand the analysis stage to accommodate a wider range of design variables in an effort to promote transfer of training (Richey, 1995). The second is a recognition that many

expert designers use other methods that do not depend upon such analysis (Tripp, 1994). Both trends are occurring in the midst of extreme pressure, especially in the world of business, to reduce the design cycle time.

Before predicting the continuing influence of Gagne with respect to pre-design analysis, it is important to try to do justice to his position. With respect to the use of analysis and the construction of learning hierarchies, Gagne has cautioned against rigid use of the technique. For example, he recognizes that a learning hierarchy is not necessarily the sequence by which an *individual* learner will acquire a particular capability, rather it is the most probable route to transfer of training for most people. He also cautions against emphasizing verbal knowledge in a hierarchy at the expense of the underlying intellectual skills.

These arguments (made over twenty-five years ago) may anticipate, at least in part, current analysis trends. The expansion of the analysis phase today represents not only the increased attention being given to learner characteristics and context, but also a new adherence to designing instruction focused upon larger content units. This latter move is, of course, consistent with Gagne and Merrill's (1990) advocacy of integrated goals as well as Gagne's initial position favoring hierarchies that focus on larger intellectual skills rather than discrete pieces of knowledge. The increased use of analysis is a direct extension of Gagne thinking, even though there may be some debate as to the legitimate focus of such analytic activity.

On the other hand, the findings of recent designer decision-making research draw a picture of expert designers working in a far less structured manner, responding spontaneously to situations which "trigger opportunistic excursions that yield unexpected insights into the problem" (Tripp, 1994, p. 117). However, Tripp also cites other research that shows designers using a *combination* of systematic analysis and opportunistic tactics. While Gagne has not specifically addressed this topic, it seems likely that he would support the latter approach.

Most designers today are under great pressure to produce a product in a shorter period of time than one would think realistic. While they know those procedures that are "textbook perfect", they face daily demands that they take shortcuts. The first steps to be slashed typically relate to evaluation and a detailed analysis of both content and needs. However, many designers are seeking ways to adhere to the time-proven methods and still be realistic in a business sense. Rather than sacrificing pre-design analysis standards, one salvation may be the use of computer-based design tools. Those tools that relate to content analysis, however, are based for the most part on Gagne techniques. Early work in this area has been completed by Gustafson and Reeves (1990) and Merrill, Li, and Jones (1990).

Another current effort to increase the efficiency, as well as the effectiveness, of the typical design task involves the use of rapid prototyping. Tripp and Bichelmeyer (1990) describe this methodology as one in which "after a succinct statement of needs and objectives, research and development are conducted as parallel processes that create prototypes, which are then tested and which may or may not evolve into a final product" (p. 35). As with the use of computer-based design, rapid prototyping builds upon traditional design practice although the stages are not linear in nature (Jones, Li, & Merrill, 1992). Content analysis in the Gagne tradition, however, is central to the early rapid prototyping stages in a similar fashion to its use in conventional systematic design. Other traditional design tools, many of which were introduced by Gagne, also have the ability to transcend current changes in our work environments. Many of these changes are precipitated by the availability of the new technologies, and even though Gagne's orientaion is not dominanted by technology it nonetheless accommodates technology's capabilities.

*The Continuing Dominance of the Events of Instruction*

Another important tool for designers has been the use of Gagne's Events of Instruction (Gagne, 1985, 1988; Gagne, Briggs, & Wager, 1992). The "Events" serve as a conceptual model for the design of lessons, the selection of instructional strategies, and the sequencing of instruction. In essence the "Events" summarize much of the key research related to instruction, including factors such as motivation, perception, feedback, reinforcement, individual differences, retention, and transfer. They provide a framework for creating those external conditions that promote learning.

Inherent in the "Events" is the notion of designer control of instructional options. While this is at odds with some constructivist theory, it is nonetheless consistent with the vast majority of the design practice in education and training environments today. The "Events" have been used regardless of the delivery medium, encompassing everything from stand-up training to computer-based instruction. For many expert designers the "Events" are now an internalized model that guides their work on a seemingly intuitive level. This is reflective of Duffy and Jonassen's (1991) assertion that "while instructional designers typically may not have the time or support to explicitly apply a theory of learning during a design or development task, the theory is nonetheless an integral part of the instruction that is produced" (p. 7).

While some may disagree on the particular strategy that is best for a given situation, there is little disagreement with the Events of Instruction themselves because they summarize key *stages* in the instructional process which have been repeatedly validated in the research literature. For example, conscious learning in a formal instructional



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environment requires attending to the topic and guidance, as well as reinforcement. While there are various strategies for accomplishing these tasks, one must be selected. As such, the general framework provided by the "Events" remains constant.

To a great extent the "Events" framework is likely to remain useful even in situations which have student-controlled sequencing of learning activities, as is more frequently the case in computer-based instruction. This is because the instructional events still need to be programmed and available for learner use. While it is likely that multiple strategies and activities will be incorporated into a particular piece of instruction, each of the various functions of instruction (as suggested by the "Events" model) must still be accommodated. Such structure is as appropriate for designing individualized environments, as it has proven to be for the design of teacher-directed instruction.

*The Stability of Gagne's Orientation to Practice*

Gagne has consistently argued that instructional design practice should be based upon what we know about human learning. This position is seemingly axiomatic. Since it is unclear to most that the field currently has a completely accurate view of all human learning, it is possible that the stability of Gagne's orientation to design practice is assured because of our tendency to combine ideas from a variety of plausible explanations of the learning process.

However, practice techniques, even when based upon complex theory, often tend to be streamlined and simplified. Perhaps this accounts for the fact that there has been less debate related to design practice than theory, and for many of Gagne's practice techniques to remain current even in the midst of great theoretical debate. Bednar, et al. (1992) are not satisfied with the field's tendency to create a patchwork collection of tools and techniques that have been abstracted from different (and often conflicting) theories being used in a given design project. They argue that this eclectic approach does *not* produce the most effective instruction.

In any case, Gagne's basic orientation has become ensconced in design tradition, even *with* the emergence of new theory. Most trained instructional designers select their design focus depending upon the nature of the learning task, and are likely to continue this practice. Most will continue to conduct some sort of pre-design content analysis as a precursor to sequencing and identification of prerequisite skills -- even if they not *overtly* use the learning hierarchy tool. Most will continue to select instructional strategies based upon a general Events of Instruction framework -- even if it is internalized and not consciously used. To some extent this begs the question of whether *expert* designers who demonstrate alternative design decision-making patterns are really deviating from the Gagne tradition or are still using the same principles.

If major deviations from the Gagne orientation do occur, it is typically because time limitations are posing barriers to their use. Such pressures are leading to a reexamination of design practice. However, most are directing their efforts towards ways of increasing design efficiency using the same basic orientation, rather than making a sharp break with past tradition. Dick (1993) calls this process the *enhancement* of the instructional systems design process. Even time saving design models such as Tessmer and Wedman's (1990) Layers of Necessity approach, which suggests a way to streamline the process given the demands of a given situation, does not radically change the fundamental orientation to design. Thus, it seems that the basic Gagne approach will continue to provide direction to the field, even given the likely changes and advancements in design tools and techniques.

## Conclusion

Robert Gagne has substantially shaped a new field of instructional design during his career as a psychologist. He made enormous contributions and had an enormous impact as both a researcher and a practitioner. While design has been called a "linking science", Gagne himself has also served a linking role throughout his career. He has linked the heyday of behavioral psychology with the dominance of cognitive psychology. He has linked the field's emphasis on designing educational programs for children with an emphasis on designing training programs for adults in the military and in business settings. He has linked basic learning research to applied educational research. He has linked theory to practice.

In his more than 50 years of active work, Gagne explored the complex processes of learning and instruction, and explained them to generations of designers in a simple, understandable way. In the process he has demonstrated his true genius. Gagne's work was spurred on by important social events that highlighted its importance and need for the general public rather than only a small intellectual community. There was an urgent need for efficient, effective training early in World War II. The Sputnik crisis in the 1950's highlighted the need for American schools to reinforce mathematics and science education. American corporations looked to education and training as an avenue to retool their workforces and meet foreign competition. His research and the successful application of this research in a variety of settings provided

evidence of its relevance and practicality. In addition, its legitimacy was rooted in scientific authority and superior academic credentials.

Gagne's ideas were part of other prominent intellectual movements over the years, including both behavioral and cognitive psychology, general systems theory, and the early explorations into the nature of instructional theory. He was a contemporary of other giants of the world of education scholarship, including persons such as Benjamin Bloom, Jerome Bruner, John Carroll, Robert Glaser, and Ralph Tyler. In retrospect, there was a social and intellectual climate in the United States that was conducive to the proliferation and acceptance of Gagne's work.

Today, the field of instructional design has grown. It has many areas of specialization, many delivery options, and many alternative theoretical perspectives that command considerable support. Furthermore, there are far more people involved in the field. This growth in itself is testament to Gagne's work. However, this more complex environment may greatly reduce the possibilities of one person alone exercising the same over-arching dominance of a Robert Gagne.

Yet Gagne's influence is surely attributed to more than "being in the right place at the right time". Ultimately, his influence is a product of the power of his ideas. His influence is a product of those seemingly simple principles which most of us are still re-examining and continuing to find that they provide new meaning and new direction. Is that not the power of an intellectual legacy? The ideas continue, and new generations meet them, become engaged, and have yet another "Eureka" experience.

## References


Bednar, A.K., Cunningham, D., Duffy, T.M., & Perry, J.D. (1992). Theory into practice: How do we link? In T.M. Duffy & D.H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (pp. 91-98). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Canada, K. & Brusca, F. (1991). The technological gender gap: Evidence and recommendations for educators and computer-based instruction designers. *Educational Technology Research and Development, 39*(2), 43-51.

Clark, R.E. & Voogel, A. (1985). Transfer of training principles for instructional design. *Educational Communications and Technology Journal, 33*(2), 113-123.

Dick, W. (1992). An instructional designer's view of constructivism. In T.M. Duffy & D.H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (pp. 17-34). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Dick, W. (1993). Enhanced ISD: A response to changing environments for learning and performance. *Educational Technology, 33*(2), 12-16.

Duffy, T.M. & Jonassen, D.H. (1991). Constructivism: New implications for instructional technology? *Educational Technology, 31*(5), 7-12.

Gagné, R.M. (1962). The acquisition of knowledge. *Psychological Review, 69*, 355-365.

Gagne, R.M. (1965). *The conditions of learning*. New York: Holt, Rinehart & Winston.

Gagne, R.M. (1968a) Contributions of learning to human development. *Psychological Review, 75*, 177-191.

Gagne, R.M. (1968b). Learning hierarchies. *Educational Psychologist, 6*, 1-9.

Gagne, R.M. (1972). Domains of learning. *Interchange, 3*, 1-8.

Gagne, R.M. (1988). Mastery learning and instructional design. *Performance Improvement Quarterly 1*(1), 7-18.

Gagne, R.M., Briggs, L.J., & Wager, W.W. (1992). *Principles of instructional design* (4th Ed.). Fort Worth, TX: Harcourt Brace Jovanovich, Publishers.

Gagné, R.M. & Merrill, M.D. (1990) Integrative goals for instructional design. *Educational Technology Research & Development, 38*(1), 23-30.

Gilligan, C. (1982). *In a different voice: Psychological theory and women's development*. Cambridge, MA: Harvard University Press.

Gustafson, K.L. & Reeves, T.C. (1990). IDioM: A platform for a course development expert system. *Educational Technology, 30*(3), 19-25.

Hannafin, M.J. (1992). Emerging technologies, ISD, and learning environments: Critical perspectives. *Educational Technology Research and Development, 40*(1), 49-63.

Jonassen, D.H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational Technology Research and Development, 39*(3), 5-14.

Jones, M.K.; Li, Z.; & Merrill, M.D. (1992). Rapid prototyping in automated instructional design. *Educational Technology Research and Development, 40*(4), 95-100.

Keller, J.M. (1987). The systematic process of motivational design. *Performance and Instruction, 26*(10), 1-8.

Kember, D. & Murphy, D. (1990). Alternative new directions for instructional design. *Educational Technology, 30*(8), 42-47.

Lebow, D. (1993). Constructivist values for instructional systems design: Five principles toward a new mindset. *Educational Technology Research and Development, 41*(3), 4-16.

Merrill, M.D. (1992). Constructivism and instructional design. In T.M. Duffy & D.H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (pp. 99-114). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Merrill, M.D.; Li, Z.; & Jones, M.K. (1990). Second generation instructional design. *Educational Technology, 30*(2), 7-14.

Merrill, M.D., Li, Z.; & Jones, M.K. (1991). Instructional transaction theory: An introduction. *Educational Technology, 31*(6), 7-12.

Perkins, D.N. & Salomon, G. (1989). Are cognitive skills context-bound? *Educational Researcher, 18*(1), 16-25.

Reigeluth, C.M. & Stein, F.S. (1983). The elaboration theory of instruction. In C.M. Reigeluth (Ed), *Instructional design theories and models* (pp. 338-381). Hillsdale, NJ: Lawrence Erlbaum Associates.

Richey, R.C. (1992). *Designing instruction for the adult learner: Systemic training theory and practice*. London: Kogan Page, Ltd.

Richey, R.C. (1993). Instructional design theory and a changing field. *Educational Technology, 33*(2), 16-21.

Richey, R.C. (1995). Trends in instructional design: Emerging theory-based models. *Performance Improvement Quarterly, 8*(3), 96-110.

Richey, R.C. & Tessmer, M. (1995). Enhancing instructional systems design through contextual analysis. In B. Seels (Ed.), *Instructional design fundamentals: A reconsideration* (pp. 187-197). Englewood Cliffs, NJ: Educational Technology Publications.

Seels, B.B. & Richey, R.C. (1994). *Instructional technology: The definition and domains of the field*. Washington, DC: Association for Educational Communications and Technology.

Streibel, M.J. (1991). Instructional plans and situated learning: The challenge of Suchman's theory of situated action for instructional designers and instructional systems. In G. J. Anglin (Ed.), *Instructional technology: Past, present, and future* (pp. 117-132). Englewood, CO: Libraries Unlimited.

Tessmer, M. & Wedman, J.F. (1990). A layers-of-necessity instructional development model. *Educational Technology Research and Development, 38*(2), 77-85.

Tripp, S. D. (1994). How should instructional designers be educated? *Performance Improvement Quarterly, 7*(3), 116-126.

Tripp, S. & Bichelmeyer, B. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational Technology Research and Development, 38*(1), 31-44.